



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/665,422	09/20/2000	Bin Zhao		7422

25700 7590 06/20/2003

FARJAMI & FARJAMI LLP
16148 SAND CANYON
IRVINE, CA 92618

EXAMINER

DIAZ, JOSE R

ART UNIT	PAPER NUMBER
----------	--------------

2815

DATE MAILED: 06/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

09/665,422

Applicant(s)

ZHAO ET AL.

Examiner

José R Díaz

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 April 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

➤ Applicant's election without traverse of claims 1-8 in Paper No. 8 is acknowledged.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

➤ Claims 1-8 are rejected under 35 U.S.C. 102(e) as being anticipated by anticipated by Zhao (US Pat. No. 6,211,561 B1).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Regarding claim 1, Zhao teaches a method of forming a semiconductor device comprising the steps of: (a) fabricating the damascene structure (22) to a via level through a processing step prior to forming contact vias (30) (see Figs. 5 and 9); (b) etching one or more air trenches (22) into the damascene structure so that the air trenches are positioned between selected metal lines (16) (see Fig. 5); and (c) depositing a sealing layer (26) over the damascene structure having air trenches to seal the air trenches (see Fig. 6).

Regarding claim 2, Zhao further teaches that the step (a) comprises the following steps: depositing a multi-layer material (30, 60) comprising a first dielectric layer, a first capping layer, a second capping layer, a second dielectric layer and a third capping layer (30, 60) (see Figs. 3a-3b, col. 4, lines 44-51 and col. 5, lines 27-30 and 39-41).

Regarding claim 3, Zhao further teaches etching an air trench (22) in the multi-layer material (30, 60) (see Fig. 5).

Regarding claims 4 and 6-8, Zhao further teaches forming a via (28) in the sealing layer and the damascene structure (see Figs. 8 and 14); forming a metal plug (30) (see Fig. 9); forming a trench over the sealing layer (see Figs. 9-10); and forming a conductive layer (32) (see Figs. 11-12).

Regarding claim 5, Zhao further teaches depositing an etch stop layer (26) over the sealing layer (26) (see col. 7, lines 24-28); forming a via (28) in the sealing layer, the etch stop, and the damascene structure (see Figs. 8 and 14);

forming a metal plug (30) (see Fig. 9); forming a trench over the etch stop layer (see Figs. 9-10); and forming a conductive layer (32) (see Figs. 11-12).

➤ Claims 1, 4 and 6-8 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang (US Pat. No. 6,159,840).

Regarding claim 1, Wang teaches a method of forming a semiconductor device comprising the steps of: (a) fabricating the damascene structure (212a, 212b) to a via level through a processing step prior to forming contact vias (220) (see Figs. 2B and 2F); (b) etching one or more air trenches (212b) into the damascene structure so that the air trenches are positioned between selected metal lines (202) (see Fig. 2B); and (c) depositing a sealing layer (214) over the damascene structure having air trenches to seal the air trenches (see Fig. 2C).

Regarding claims 4 and 6-8, Wang further teaches forming a via (212a) in the sealing layer and the damascene structure (see Fig. 2E); forming a metal plug (220) (see Fig. 2F); forming a trench (218) over the sealing layer (see Figs. 2E); and forming a conductive layer (220) (see Figs. 2F).

Conclusion

➤ The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Zhao (US 2002/0016058 A1 and US Pat. No. 6,509,623 B2) discloses a method of forming an air gap in a damascene structure (see abstracts); Chooi et al. (US Pat. No. 6,265,321 B1) discloses a method of forming air gaps in a

Art Unit: 2815

interconnect structure (see abstract); Lee et al. (US Pat. No. 6,4921,256 B2) discloses a method of forming air gaps in a interconnect structure (see abstract); and Pang (US Pat. No. 6,177,329 B1) discloses a method of forming air gaps in a interconnect structure (see abstract).

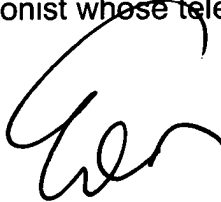
Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R Díaz whose telephone number is (703) 308-6078. The examiner can normally be reached on 9:00-5:00 Monday, Tuesday, Thursday and Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 746-3891 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JRD
June 12, 2003



EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800